

Xenoliths in Eocene lavas from Central Tibet record carbonated metasomatism of the lithosphere

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Cenozoic post-collisional volcanism of the Tibetan Plateau, emplaced on an accreted continental margin under compression, could bring important information regarding the edification of the Plateau. In this study, we combined petrography, whole rock geochemistry, stable isotopes and *in situ* mineral analysis to decipher the genesis of Eocene-Oligocene magmatic rocks from the Nangqian basin (35-38 Ma, [Spurlin *et al.*, 2005; Xu *et al.*, 2016]), located at the hinge between Central Tibet and the Eastern Indo-Asia Collision Zone.

Our dataset includes potassic trachyandesites; amphibole-bearing potassic trachytes; and rare ultrapotassic ($K_2O/Na_2O \geq 4$) mafic syenites. All samples have high REE abundances ($La = 100 - 500 \times$ primitive mantle). Fractionation of heavy REE ($Gd/Yb_N > 3$) indicates melting in the garnet stability field, and relative depletion in high-field strength elements (Nb, Ta) indicates a selective enrichment of the source by metasomatic fluids. This metasomatism event is also evidenced by the occurrence of re-equilibrated mantle xenocrysts of phlogopite ($Mg\# = 88 - 90$ and Cr_2O_3 content = 0.9 - 1.82 wt%) in mafic syenites.

Potassic trachyandesites have specific composition, with negative Zr-Hf anomaly and low Hf/Sm (0.2 - 0.4). Indeed, they include xenocrystic aggregates, composed of magmatic clinopyroxene, apatite and subordinate biotite and feldspar, with interstitial calcite and dolomite. $\delta^{18}O_{V-SMOW}$ (9.2 - 11.0 ‰) and $\delta^{13}C_{V-PDB}$ (-6.1 - -4.0 ‰) of these rocks indicate the presence of primary, mantle-derived carbonates. *In situ* analysis of the major and trace element compositions of the carbonates, clinopyroxenes and apatites further suggest that these aggregates represent cumulates of a carbonate-bearing magma. These xenoliths thus show that the lithospheric mantle was also metasomatized by CO_2 -rich fluids.

Cenozoic carbonatites in China have been identified in Maoniuping in Western Sichuan (31.7 Ma), Lixian in the Western Qinlin (22-23 Ma), and Nanjagbarwa in the Tethyan Himalayas (3.6-5.5 Ma) [Yang and Woolley, 2006]. Considering as such the Nangqian xenocrystic cumulates, Eocene carbonatites preferentially occurred on the three edges of the Songpan-Ganze block, and we propose that their mantellic sources were all affected by an input of subducted carbonates during the Triassic closure of the Songpan-Ganze ocean. Ages and local field relationships furthermore indicate that melting occurred during Eocene-Oligocene compressive events that propagated outward from the Songpan-Ganze block, suggesting renewed subduction of the block margins following the onset of the India-Asia collision.

References:

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